Chapter One
PROGRAM INITIATION PHASE
(PRE-MILESTONE 0)

INTRODUCTION

A Program Manager is often not formally assigned by charter at this phase of the acquisition process, however, the Hardware Systems Command assigns an action officer (the defacto "Program Manager.") His actions establish the initial baseline against which all follow-on documentation and data is compared.

The Program Manager has many responsibilities and objectives in this phase of the acquisition, but this handbook addresses only those that directly impact operational availability (A_O) and its elements -- reliability, maintainability and supportability -- as discussed individually in detail in Appendices D,E, and F.

The Program Manager's objectives with regard to A_O from program initiation until Milestone 0, are to:

- Refine the performance levels provided in the Tentative Operational Requirement (TOR) to measures of performance that can be verified through testing and evaluation
- Determine estimates of the costs to achieve each capability required in the TOR
- Develop alternatives that are achievable and satisfy the requirements of the TOR
- Determine the degree of risk for each achievable alternative.

ESTABLISHING THE A_O REQUIREMENT

What Key Actions Must be Completed?

1. Analyze the operational scenario: Establish a quantitative, and where that is not possible, a qualitative description of the system's required mission profile, frequency, and duration; determine the critical assumptions about the operational use, system design and support concepts upon which the supportability values are based.

2. Estimate achievable A_O and costs: Estimate the achievable levels of system reliability and supportability and the costs to achieve those levels; calculate the achievable A_O values and compare to the required A_O.

What Data Inputs and Outputs are Necessary to Complete These Actions?

Inputs

From the TOR the Program Manager is given the OPNAV Sponsor's:

- description of the mission frequency and duration, and other measures of merit
- description of the perceived threat, including technologically achievable threats over the life of the system
- general statement of the capabilities required for both mission performance and supportability
- the anticipated number of systems to be procured
- direction regarding integrated logistic support (ILS)
- estimates of what resources might be available to procure the system and its support

From operational data on existing systems the following is obtainable:

- the achieved A_O of current, similar operational systems, subsystems, or components including achieved reliability, maintainability and supportability values
- the costs of current operational systems, subsystems or components.
- the readiness drivers of current operational systems
- any special design requirements or extraordinary support system performance requirements.

From the Research and Development and Engineering communities the following is obtainable:

- technologies under development, including their expected maturity, their estimated timeframe for readiness for production and risks
- anticipated reliability of those technologies relative to current technology.

Outputs

For each proposed system alternative the Program Manager documents, as required by OPNAVINST 5000.42C (NOTAL), the following:

- A_O levels that are attainable and acceptable to meet the threat
- estimated costs for development, production, and life-cycle operation and support of each system alternative
- risks inherent in achieving the desired levels of A_O for each alternative.

How Should the Actions be Completed?

At this phase of the acquisition, the Program Manager has more unknowns than knowns, and more generalities than specifics, but fewer constraints than at any time in the system acquisition. At program initiation, he develops a systematic and documented baseline record of the acquisition program that will be maintained throughout the life cycle of the system.

In the areas of readiness and supportability, MIL-STD-1388-1A provides a structured, task oriented approach for the logistic support analysis (LSA) aspects of the acquisition that is easily adapted to other functional areas. For the purposes of this handbook, MIL-STD-1388-1A is the best guide, since the Program Manager is concerned with only three elements in the consideration of A_O:

- Reliability as measured by Mean Time Between Failure (MTBF)
- Maintainability as measured by Mean Time to Repair (MTTR)
- Supportability as measured by Mean Logistic Delay Time (MLDT).

As discussed in Volume I and Appendix B, these quantifiable and measurable elements are used to develop the single measure of system material readiness in the equation:

$$A_O = \frac{MTBF}{MTBF + MTTR + MLDT}$$

The Program Manager is required to determine what is known, identify the unknowns, and develop a matrix that compares and contrasts the many factors emerging from the vast amounts of data that he reviews. This matrix focuses the Program Manager's efforts on critical capabilities, quantifiable versus qualitative factors, and makes the absence of critical information obvious.

The Resource Sponsor identifies deficiencies in similar, existing systems that make them inadequate to counter the future threat. Any constraints in terms of affordability, operational, physical, technological or scheduling are given to the Program Manager in the TOR. These factors are the basis for the matrix against which the Program Manager compares and contrasts all existing, similar systems and system alternatives.

Analyzing the Operational Scenario

The first step is to conduct a Use Study in accordance with Task 201 of MIL-STD-1388-1A. The Use Study identifies many factors regarding the intended use of the new system, but those most pertinent to A_O are: the number of missions per unit of time, mission duration, number of operating days, miles, hours, firings, flights or cycles per unit of time; peacetime and wartime employment; operating scenario; basing concept; and operating environment. Any mission area or weapon system analysis which quantifies relationships between hardware, mission and supportability parameters, and is also pertinent to the new system, should be identified and documented in the Use Study.

The Use Study further clarifies the general guidance of the TOR by identifying the following:

- the type of system: e.g. Anti-Air Warfare (AAW), Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASUW)

- the category of platform that employs the system: e.g. surface ship, submarine or aircraft, and the type of platform within that category: aircraft carrier, cruiser, frigate

- the concept of operations: e.g. carrier battle group, surface battle group, independent operations

- the type of threat: e.g. stand-off air delivered missile, stand-off surface delivered missile, submarine

- the key capabilities required: e.g. over-the-horizon ASW, AAW out to 200 miles and up to 50,000 feet altitude

- logistic planning requirements: e.g. unique maintenance concepts; fifteen days continuous, independent operations isolated from resupply; continuous availability for a seventy-five day operating cycle.

Since a Use Study will naturally expand upon, clarify, or make assumptions regarding operational use, it is essential that the Program Manager get the Resource Sponsor's formal approval of the completed study. Upon completion of the Use Study, the next step in completing this key action is to conduct a Baseline Comparison System (BCS) study. The initial requirement is to identify all existing systems similar to the system described by the Use Study. At this time the matrix developed from the TOR and Use Study becomes invaluable to the Program Manager. The BCS quantifies the A_O, MTBF, MTTR, MLDT currently achieved in the fleet. It will confirm or contradict critical assumptions about operational use, critical design considerations and support concepts. Analysis of historical data on the BCS provides quantifiable statistics that form the baseline for satisfying an estimation of the achievable A_O and costs.

Estimating Achievable A_O and Costs

BCS data provide the Program Manager with the lower bound of achievable capability. On nearly all existing systems, the program management office or in-service engineering agent has accomplished an assessment of the system which reports the system's performance in terms of reliability (MTBF), maintainability (MTTR), and supportability (MLDT), as well as manpower requirements and operating and support costs. These reports usually identify readiness drivers within the system, provide critical parts usage/failures, system characteristics, and identify other data sources. The Program Manager can use this data to develop baseline statistics necessary to perform the comparative analysis required to respond to the TOR. The program management office of the existing, similar system should also be able to furnish the maintenance plan, integrated logistic support plan (ILSP), and the reliability block diagrams. These provide the Program Manager with a baseline maintenance concept, support concept, and a diagram of the functional relationships among the major components of the baseline system. The Naval Supply Systems Command can provide the dollar value of a shipset of spares and repair parts for the comparative system and also mean logistic support times. OPNAV (OP-91) maintains data on the operational, maintenance, and support costs of operational ships, aircraft and systems, and can also provide costing factors that can be used for cost estimation purposes. The research and development community is able to furnish any advances in technology that provide enhancements to the capabilities of the comparative system.

The BCS and the Use Study are the foundation for the remaining actions in this phase of the acquisition. The completed BCS provides the MTBF, MLDT, support costs, maintenance concept, achieved A_O, operational use and scenario, and the readiness and cost drivers of the

to A_O or MTBF as • A series of cost to benefit curves comparing the cos

comparative (existing, similar) systems. The Use Study provides indicators of most of this same data desired in the new system.

With the completion of the BCS and Use Study, the Program Manager begins developing alternatives that achieve the capabilities required by the TOR. Most new systems are enhancements to existing systems and few, if any, systems are developed from the drawing board with completely new, state-of-the-art technology.

As the Program Manager develops system alternatives he should continually compare and contrast the characteristics of the alternative system against the baseline characteristics derived from the TOR, Use Study, and BCS. Although there are numerous characteristics, both quantitative and qualitative, describing the system concept, the Program Manager is concerned, regarding A_O, with those that quantify or impact the quantification of MTBF, MTTR, and MLDT. The quantification of these elements of A_O enables the Program Manager to satisfy Key Action 2.

The two extremes on the spectrum of alternatives available to the Program Manager are: (1) countering an existing threat with an off-the shelf system at the low end of the spectrum in terms of design freedom and risk; and (2) countering a new threat with advanced technological development at the other end of the spectrum.

Off-The-Shelf-System/Existing Threat The system is intended to replace an existing system with perhaps no change in the intended operating characteristics nor of the combat environment in which the system is intended to function. In this case the system is being introduced to improve one or more of the following: reliability, maintainability, logistic support, or to upgrade mission performance.

Advanced Technological Development/New Threat The system under consideration performs a totally new warfare function or mission, or meets a previously undefined threat. In this case, the system has no directly analogous counterpart in the inventory. A comprehensive threat analysis that models system applications on its intended platform in a specified combat environment, is paramount in establishing both system technical operation characteristics and the required mission effectiveness.

There is a wide range of alternatives between these two extremes. The following alternatives represent two possibilities.

Government Furnished Equipment (GFE) The system does not exist, but the great majority of required sub-systems and component equipment are in operation. These sub-systems and component equipment are integrated into a new composite system made up of sub-components of known performance. The key to the evaluation of A_O is the degree of change in reliability, maintainability, or logistic support of the composite system, as compared to the individual component characteristics as a result of the effect of different operational use and environment on those subsystem characteristics.

Modest Upgrade The new system is an evolution of a current system already in operation. Areas of new design may extend across the entire system, or may affect only specific subsystems or components. The acquisition of the new system is intended to improve system operation characteristics or to provide enhanced mission effectiveness. The key to the evaluation of this case is the degree of improved system performance.

The Program Manager selects and rejects alternatives on the basis of achievability, satisfaction of the capabilities in the TOR, acceptable risk, and cost (which will be addressed later in this chapter). In effect, the Program Manager is conducting a marginal analysis of reliability and supportability to determine the effects on A_O by varying the two elements.

Key Action 2 is completed through this marginal analysis. The lower bound of A_O is what is currently being achieved with current reliability and supportability. The upper bound of A_O is the lower of the alternative that meets the capabilities in the TOR, exceeds affordability constraints or represents unacceptable technological risk.

What Documentation is Required?

The minimum documentation required from the Program Manager by program decision authorities prior to MILESTONE 0 is:

- Development Options Paper (DOP)
- Supporting baseline management documentation (large, complex systems only; i.e. ACAT I and II and some ACAT III programs)
  - Baseline Comparison System (BCS) (only necessary for large, complex systems)
  - Use Study (only necessary for large, complex systems).

MONITORING AND EVALUATING THE A_O REQUIREMENT AND RELATED RESOURCE REQUIREMENTS

The Program Manager is responsible for preliminary analyses which compare A_O performance of similar systems to determine the achievability of the A_O established in the TOR.

CONDUCTING COST-BENEFIT TRADE-OFF ANALYSES TO SUPPORT THE A_O REQUIREMENT

What Key Actions Must be Completed?

1. Perform trade-off analyses among A_O elements (if required to optimize achievable A_O) within constraints of cost, schedule or technology.
2. Compare costs and select/reject alternatives.

What Data Inputs and Outputs are Necessary to Complete These Actions?

Inputs

- From the TOR the Program Manager is given the affordability constraints and schedule/time constraints.
- Analysis of historical data on the BCS provides:
  - Comparative system A_O, MTBF, MTTR, MLDT
  - Comparative system costs

- Current system readiness and cost drivers

- From the R&D, engineering and support communities are obtainable:
  - Estimated costs to achieve increased levels of reliability
  - Estimated costing factors/algorithms used in system costing.

Outputs

- Matrix of common factors and unique factors for each alternative and the cost/benefit of each alternative
- A series of cost to benefit curves comparing the cost to A_O, or MTBF as appropriate, for each alternative.

How Should the Actions be Completed?

The Program Manager must work with the Resource Sponsor to determine how much cost data is enough and how accurate the cost-to-capability must be in order for the program to proceed to MILESTONE 0. OPNAVINST 5000.42C requires that the Program Manager include in the DOP, when appropriate, cost-to-capability curves. This requirement is necessary to inform decision makers of the relationships of cost-to-capability and to identify the relative point at which an additional small amount of capability requires inordinate additional cost. Generally, the cost of a system is correlated to the A_O achieved by the system. The higher the A_O of the system, the higher the cost. Figure 1-1 is a typical A_O-to-Cost curve. The A_O is never zero because the system's inherent reliability provides some measurable availability. The A_O never achieves 100% because the system will fail. The "knee of the curve", or the point beyond which each marginal increase in A_O becomes increasingly costly is .85 for Alternative A, and .90 for Alternative B.

Basic cost elements, definitions and estimating guidance is contained in DODI 5000.33 of 15 August 1987 (NOTAL) and DODD 4245.6 of 19 January 1984 (NOTAL). Prior to MILESTONE 0, the ability to determine cost data with a great degree of reliability is extremely difficult. The cost analysis supporting a MILESTONE 0 decision should be based the following:

- Costing data on existing, similar systems from the existing system program office, OPNAV (OP-91) which maintains Visibility and Management of Support Costs (VAMOSC) and NAVSUP (SUP 031) which can provide the costs of ths spares and repair parts allowance for an existing system
- These costs are escalated using factors available in the Hardware Systems Command budget office according to the year in which the costs will be incurred
- The cost analysis identifies the risks and assumptions associated with the use of similar, existing system costs
- Identification of unique capabilities on the conceptual system for which there are no comparable capabilities on existing similar systems should be identified. The costing data associated with these increased capabilities are high risk and should be identified to the Resource Sponsor.

Total System OA : MTBF, MTTR and MLDT

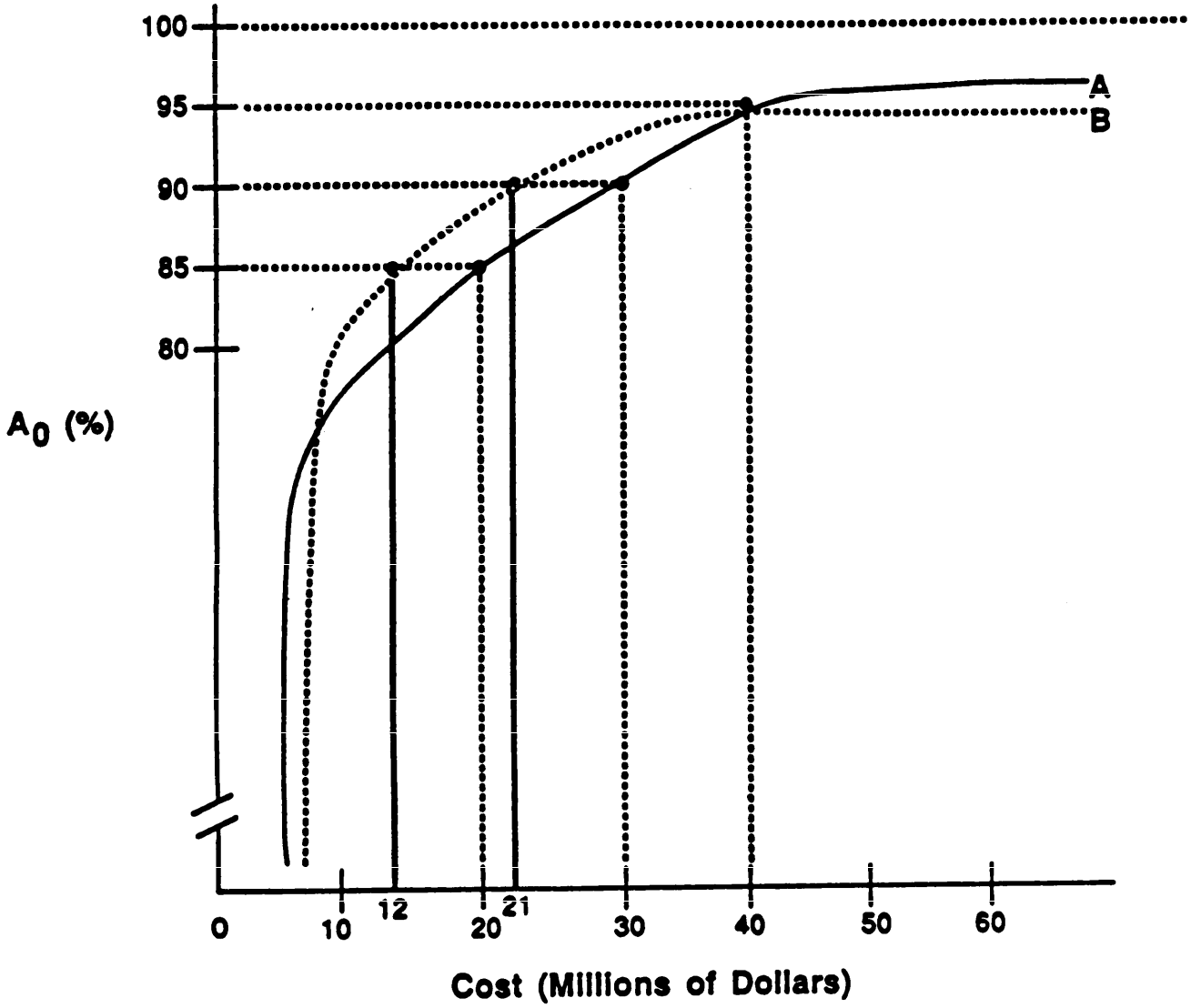

Figure 1-1: Cost-To-A_0 Curve

What Documentation is Required?

At a minimum, the costs of the comparative system and its A_O and MTBF values are provided in the DOP with the most reliable estimates of cost to A_O and MTBF for each alternative summarized in the DOP.

SUMMARY

The Program Manager drafts and staffs the DOP through the Hardware Systems Command to the OPNAV Resource Sponsor as the response to the TOR. The DOP summarizes the actions of the Program Manager in the form of a summary of each achievable alternative that satisfies the capability requirements of the TOR, and is within the constraints imposed by the TOR. When the DOP has been approved and forwarded to the Resource Sponsor, the Program Manager's PRE-MILESTONE 0 actions are not completed.

The Program Manager and Resource Sponsor now draft the Operational Requirement (OR) and begin staffing it through the Planning, Programming and Budgeting System (PPBS). The OR is susceptible to change during this process. Compromises are a probability and are tied to affordability issues. It is crucial that the Program Manager be realistic and credible during this critical phase. He must ensure that the Resource Sponsor does not promise more than is deliverable for a given resource level. The Program Manager must be able to deliver what the Resource Sponsor commits the program to accomplish. Enthusiasm and commitment to start the program must not be permitted to position the program on a course of high risk to cost growth or unlikely achievement of performance levels.

PRE-MILESTONE 0 ends with both the approval of the OR and resources in the Program Objectives Memorandum (POM). The Program Manager has a level of funding, the year that funding will be available, and what thresholds of key performance/readiness the new system will achieve, or a range of thresholds in the case of developmental programs, that will become fixed thresholds later in the developmental phase of the acquisition cycle. This constitutes the authorization for the Program Manager to proceed to the PRE-MILESTONE I phase.